



## The relation between digital literacy, cyberchondria, and parents' attitudes to childhood vaccines



Fadime Ustuner Top, PhD<sup>a,\*</sup>, Celalettin Çevik, PhD<sup>b</sup>, Nebahat Bora Güneş, PhD<sup>c</sup>

<sup>a</sup> Faculty of Health Sciences, Department of Child Health and Disease Nursing, Giresun University, Giresun, Turkey

<sup>b</sup> Faculty of Health Sciences, Department of Public Health Nursing, Balikesir University, Balikesir, Turkey

<sup>c</sup> Department of Pediatric Nursing, Faculty of Nursing, Hacettepe University, Ankara, Turkey

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### ABSTRACT

**Purpose:** This study aimed to examine the relationship between digital literacy, cyberchondria and parents' hesitancy about childhood vaccines.

**Design and methods:** The study was cross-sectional, and parents with children aged 3–5 years who had access to the questionnaire were sent online and volunteered to participate.

**Results:** The total mean score of the Parents' Attitude to Childhood Vaccines Scale was  $44.89 \pm 14.99$ , 31.3% of the parents were hesitant about childhood vaccines. Parental hesitancy about childhood vaccinations was 3.26 times (95% CI, 1.56–6.81) for single participants and 2.77 times (95% CI, 1.33–5.74) for the participants with a high school diploma than primary school graduates, 4.69 times for the participants who did not have a healthcare professional in their family (95% CI, 2.08–10.59), 16.02 times (95% CI, 6.61–10.80) for the participants who did not have a full round of vaccines, 1.81 times higher (95% CI, 1.13–2.88) than the participants who did not have enough information about vaccines. Hesitancy increased as the cyberchondria severity score increased (95% CI, 1.02–1.09), and digital literacy decreased (95% CI, 0.34–0.87).

**Conclusions:** One-third of the parents had hesitations about childhood vaccines. Vaccine hesitancy is affected negatively by digital literacy and positively by cyberchondria.

**Practice implication:** Meeting parents' accurate and reliable vaccine information will positively affect their attitudes and behaviours. Therefore, the level of cyberchondria among parents should be reduced, and their digital literacy should be increased.

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### Background

Vaccination is one of the essential inventions contributing to protecting public health and increasing life expectancy at birth (Greenwood, 2014). Through the "Extended Program on Immunization" (EPI) implemented by the World Health Organization (WHO) since 1974, morbidity and mortality of vaccine-preventable diseases have fallen significantly (Pan et al., 2021). Keeping the vaccination rates above 95% provides herd immunity and prevents epidemics of vaccine-preventable diseases. This allows some conditions that caused pandemics and killed millions in previous centuries to be eradicated (Ertugrul & Albayrak, 2021). However, parents' delaying and refusal of vaccination is a significant public health problem that threatens herd immunity and causes high morbidity and mortality (Messonnier, 2020). Vaccination hesitancy is a problem in which there are different

attitudes and behaviours based on time, place, vaccines, and the ways of expressing the rejection and delay of vaccination despite the availability of vaccination services (Matos et al., 2021). Prevalence of vaccine rejection varies between 5 and 10% in different populations (Alshammari et al., 2018; Bianco et al., 2019; Cataldi & O'Leary, 2021; Unsal, 2020). Although significant progress has been made in the fight against infectious diseases with the EIP implemented in Turkey, the number of families who refused to be vaccinated increased from 183 in 2011 to 5091 in 2015, and exceeded 23,000 in 2018 (Bozkurt, 2018). According to the 2018 Demographic Health Survey of Turkey, the percentage of fully vaccinated children aged 12 to 23 and 15 to 26 months decreased from 74% to 67% (Turkey Demographic and Health Survey, 2019).

Parents may have negative attitudes and behaviours towards vaccines depending on such factors as the necessity of vaccines, side effects, preference for complementary and alternative treatments, low health literacy, and the influence of the media (Çevik et al., 2019; Doğan, 2021; Messonnier, 2020). The media can be an essential and effective tool in spreading accurate and reliable information to large masses as

\* Corresponding author.

E-mail addresses: [fadime.ustuner@giresun.edu.tr](mailto:fadime.ustuner@giresun.edu.tr) (F. Ustuner Top), [celalettincevik@balikesir.edu.tr](mailto:celalettincevik@balikesir.edu.tr) (C. Çevik).

well as negative attitudes and beliefs about health. In this context, it is thought that digital literacy, defined by the conscious use of online media, may be a factor in vaccine hesitancy and rejection (Ashfield & Donelle, 2020). The popularity of searching for medical information online is understandable due to the potential benefits of online services, such as ease of access and low cost (Powell et al., 2011). In addition, excessive or repeated online searches for health information can trigger unnecessary health concerns, a phenomenon called “cyberchondria” (Zheng & Tandoc, 2020). Cyberchondria increases the economic cost and causes overuse of health services (Berle & Arnáez, 2020; Vladan et al., 2019). In general, the number of studies on cyberchondria has increased rapidly in recent years (Laato et al., 2020; Vismara et al., 2020; Zheng et al., 2020). However, according to the results of a systematic review, most studies rely only on cross-sectional data to investigate cyberchondria, and the sample is mostly university students or mixed populations accessed from online platforms (Zheng & Tandoc, 2020). In Turkey, there are no studies evaluating the prevalence of cyberchondria in parents, its relation to digital literacy, and its effects on parents' attitudes to childhood vaccines.

Vaccine rejection is a serious public health problem that has grown in Turkey in recent years. Because families did not leave their homes to protect themselves and their children during the COVID-19 outbreak, it has caused deficiencies or delays in the follow-up of healthy children and vaccination of children, especially in the 0–2 age group. Moreover, spreading such information during the Coronavirus Disease-19 (COVID-19) pandemic contributes significantly to adopting different vaccinations among parents. It also contributes considerably to inadequate vaccination coverage in recent years. There are limited studies on parents' digital literacy and cyberchondria status (Kırık & Çetinkaya, 2022; Özkan et al., 2022). In addition, existing studies lack research on the relationship between attitudes towards vaccination and digital literacy and cyberchondria. For these reasons, more studies are needed to shed light on the relationship between attitudes towards vaccination, cyberchondria and digital literacy. This study was planned to investigate the relationship between digital literacy, cyberchondria, and parents' hesitations about childhood vaccines.

## Methods

### Study type

This study was a cross-sectional descriptive study with a structured questionnaire implemented online between July 2021–October 2021.

### Sample size

The study population consisted of parents with children aged 3–5 years old and with social media accounts (Instagram, Facebook, Whatsapp). The sample size was calculated as 544 in the Epi Info 7.0 program (CDC, 2022), (15% prevalence, 3% deviation, 95% confidence level), and 582 people were included from 315 families via Google forms. The convenience sampling method, one of the non-probability sampling methods, was used to select the sample population.

### Variables

The study's dependent variable was parents' attitudes to childhood vaccination, and the independent variables were sociodemographic characteristics, digital literacy and cyberchondria.

### Sociodemographic information form

The sociodemographic characteristics form has been prepared based on the literature and the state, parent's age, gender, marital status, education, financial status, profession, health insurance, a health professional in the family, child age, child gender, fully vaccinated, the

reason for refusing vaccines, having sufficient knowledge, digital literacy and cyberchondria it consists of about vaccines variables (Uzun et al., 2017; Çevik et al., 2020; Doğan, 2021).

### Digital literacy scale

Digital Literacy Scale (DLS) developed by Ng (2012) consists of 17 items and four dimensions (attitude: 1–7 questions, technical: 8–13 questions, cognitive: 14–15 questions, and social: 16–17 questions). A 5-point Likert-type rating was made in the form of “Strongly Agree” (5), and “Strongly Disagree” (1) on a scale where there were no reverse-scored items. The four-factor structure obtained from the scale could be considered four different dimensions, and a total score for digital literacy could be found. The lowest score that could be obtained for the whole scale was 17, and the highest score was 85. Cronbach's alpha value was found to be 0.93 for the total score of the scale, 0.88 for the attitude sub-dimension, 0.89 for the technical sub-dimension, 0.70 for the cognitive sub-dimension, and 0.72 for the social sub-dimension (Hamutoğlu et al., 2017). Lower scores from the sub-dimensions of the Digital Literacy Scale and the overall scale indicated poor/low digital literacy, and high digital literacy suggested high digital literacy (Ng, 2012).

### Parent attitudes to childhood vaccines

Opel et al. developed the parent Attitudes to Childhood Vaccines (PACV) scale. It consists of several sub-dimensions (Çevik et al., 2020; Opel et al., 2011). It contains 15 items under three domains: behaviour (items 1–2), safety and efficacy (items 7–10), and general attitude and trust (items 3–6 and 11–15). Those who answered “Yes” to the questions about delaying vaccination and getting vaccinated were scored 2 points, “I don't know or not sure” scored 1 point, and answers without hesitation scored 0 points. Two questions in which the answer was “I don't know” were excluded as missing data (1 and 2) at the scoring phase, while the hesitant answer was given 2 points and the unhesitant answer was given 0 points. The total raw score was calculated by adding the score for each question. If all questions were answered, and 1 and 2 were excluded as missing data, the total raw score was between 0 and 30. An increase in the scale's total score indicates an increase in parents' hesitancy about childhood vaccines. A converted PACV score below 50 suggests no vaccine hesitancy, and a score of 50 or above shows vaccine hesitancy.

### Cyberchondria severity scale

Cyberchondria Severity Scale (CSS) is a measurement tool that was brought to the literature by McElroy and Shevlin (2014) to measure the level of cyberchondria of individuals and was adapted into Turkish by Uzun et al. (McElroy & Shevlin, 2014; Uzun et al., 2017). The CSS consisted of 15 items and five sub-dimensions. These sub-dimensions were compulsion, excessive anxiety, extremism, reassurance, and distrust of the doctor. Items 5, 12, and 15 in the scale were reverse scored, and the scores that could be obtained from the 5-point Likert-type scale varied between 15 and 75. Evaluation of the scale could be done by total score or sub-dimensions. High scores on the scale indicated high cyberchondria (McElroy & Shevlin, 2014).

### Data collection

Individuals who volunteered to participate in the research were reached through online platforms such as Facebook, Instagram, and LinkedIn. The online questionnaire link (Google Forms) was sent to the individuals via online media, instant message services or email. Parents who volunteered to participate in the study and filled out the online forms constituted the entire study sample. A pilot study was conducted before the research with 20 individuals who were not part

of the sample. Based on their feedback, necessary revisions were made on the questionnaire; then, the data were collected. Participation in the research is voluntary. Participants were not given any incentives or financial support to answer the questionnaire. The survey was administered within the framework of a directive and flow. It was stated that if the participants did not answer an item, they could continue with the following question of the questionnaire. To increase participation in the research, it was aimed to ensure the involvement of sharing the survey link on social media platforms four times at different times. Only 1.4% of the respondents said they did not want to continue the survey.

**Statistical analysis**

Data processing and evaluation were done using SPSS 25.0 (IBM, 2017) with a significance level of  $p < 0.05$ . In descriptive analyses, the data were presented as frequency, percentage, mean and standard deviation. Since the assumption of normality was based on the kurtosis and skewness coefficient ( $\pm 1.5$ ), student's  $t$ -test was used to compare the mean of the two groups, and the chi-square test was used to compare the categorical variables (Nash, 2001). Variables that were significant in the univariate analysis were evaluated using the logistic regression analysis in multivariate analysis. Enter method (simultaneous analysis of predictive variables) was used in binary logistic regression analysis to determine the proper relationship between variables that were significant in univariate analysis ( $p < 0.05$ ) and vaccine hesitancy (marital status, education, income, family health worker, getting the vaccines completely, having sufficient knowledge about vaccines, Cyberchondria Severity Score). We present an adjusted odds ratio (OR) with 95%CI. The Hosmer and Lemeshow test was used in the analysis to assess the Goodness of Fit test (Hosmer Jr et al., 2013). The model is correct if the  $p$ -value  $\geq \alpha$ . A correlation test was performed to determine whether there was multicollinearity with an  $a$ -value  $< 0.9$ , indicating no correlation between the variables (Alin, 2010).

**Ethical approval**

After the use and anonymization of the data and the textual explanation of the research objectives to the participants before the research, their consent to participate was requested. Those who supported and filled out the questionnaire formed the research group. There was no identifying information on any reports or publications related to this study. The approval of the Ethics Committee was obtained to conduct the study (Date:10.03.2021/Number:2021/2). The principles of the Declaration of Helsinki conducted the study. All participants provided their informed consent.

**Results**

The research was conducted with the participation of 582 people, and eight (1.4%) people whose survey link was sent did not accept to participate. According to the study's results, 77.0% of the participants were 30 years old and over, and 94.5% were mothers. Of the participating parents, 91.8% are married, 44.2% are high school graduates, 68.0% have an income equivalent to their expenses, 44.8% are homemakers, 94.8% have health insurance, 16.5% of them have health personnel in their family, and 42.6% of the participants have children aged 3–5 years, 51.5% of whom are boys.

It was stated that 9.1% of the parents did not have their children fully vaccinated, 28.3% were affected by anti-vaccination news on social media, and 24.5% of the participants did not have their children fully vaccinated immunised because they thought the vaccine was not reliable. 39.7% of the parents participating in the study reported that they did not have enough vaccine information (Table 1).

Parent's age, child age, CSS and sub-dimensions, DLS and sub-dimensions, PACV and sub-dimensions in the research group are

**Table 1**  
Sociodemographic characteristics of participants (n = 582).

| Variables  | n   | %    |
|--|-----|------|
| Parent's age   |     |      |
| 18–29  | 134 | 23.0 |
| 30 and above   | 448 | 77.0 |
| Parent's gender                                      |     |      |
| Female   | 550 | 94.5 |
| Male   | 32  | 5.5  |
| Marital status                                       |     |      |
| Married  | 534 | 91.8 |
| Divorced   | 40  | 6.9  |
| Single   | 5   | 0.9  |
| Living apart   | 3   | 0.5  |
| Education  |     |      |
| Primary school                                       | 99  | 17.0 |
| High school  | 257 | 44.2 |
| University   | 226 | 38.8 |
| Financial status                                     |     |      |
| Less income than expenses                            | 132 | 22.7 |
| Equal income-expenses                                | 396 | 68.0 |
| More income than expenses                            | 54  | 9.3  |
| Profession   |     |      |
| Housewife  | 261 | 44.8 |
| Officer  | 204 | 35.1 |
| Worker   | 36  | 6.2  |
| Private sector employee                              | 34  | 5.8  |
| Non-worker   | 47  | 8.1  |
| Health insurance                                     |     |      |
| Yes  | 552 | 94.8 |
| No   | 30  | 5.2  |
| Health professionals in the family                   |     |      |
| Yes  | 96  | 16.5 |
| No   | 486 | 83.5 |
| Child age  |     |      |
| 3  | 248 | 42.6 |
| 4  | 171 | 29.4 |
| 5  | 163 | 28.0 |
| Child gender   |     |      |
| Female   | 282 | 48.5 |
| Male   | 300 | 51.5 |
| Fully vaccinated (n = 562)                           |     |      |
| Yes  | 529 | 90.9 |
| No   | 53  | 9.1  |
| Reason for refusing vaccines (n = 53)                |     |      |
| Social media   | 15  | 28.3 |
| The belief that vaccines are not helpful             | 13  | 24.5 |
| Side effects   | 10  | 18.9 |
| Distrust of vaccines                                 | 8   | 15.1 |
| Preferring complementary therapy instead of vaccines | 5   | 9.4  |
| Being affected by others' suggestions                | 2   | 3.8  |
| Having sufficient knowledge about vaccines           |     |      |
| Yes  | 351 | 60.3 |
| No   | 231 | 39.7 |

presented in Table 2. Accordingly, the mean parent's age of the study group was  $34.49 \pm 6.12$ , the child's age was  $3.86 \pm 0.82$ , and the CSS score was  $3.86 \pm 0.82$ . The highest of the CSS sub-dimensions is extremism, while the lowest sub-dimension is a compulsion. The DLS total score in the research group was  $55.69 \pm 9.05$ , the highest score was the technical sub-dimension, and the lowest sub-dimension score was the social sub-dimension. One-third of the people in the study group were hesitant about the vaccine, and the PACV total score was  $44.89 \pm 14.99$ . The highest PACV sub-dimension score is safety and efficacy, while the lowest is behaviour (Table 2).

Table 3 presents the PACV score according to the independent variables. Accordingly, the PACV score was unmarried ( $\chi^2 = 15.187, p = 0.001$ ), high school graduate ( $\chi^2 = 31.311, p = 0.001$ ), income equal to expenditure ( $\chi^2 = 8.452, p = 0.001$ ), and non-health workers ( $\chi^2 = 0.001, 23.264, p = 0.001$ ), those who did not have all their vaccinations ( $\chi^2 = 44.300, p = 0.001$ ), and those who had insufficient knowledge about vaccinations ( $\chi^2 = 5.440, p = 0.020$ ). In addition, individuals with high CCS ( $t = -5.642, p = 0.001$ ) had higher PACV scores than individuals with low DLS ( $t = 3.324, p = 0.001$ ) (Table 3).

**Table 2**  
Characteristics of some metric variables in the research group  
(n = 582).

| Variables           | Mean ± SD     |
|---------------------|---------------|
| Parent's age        | 34.49 ± 6.12  |
| Child age           | 3.86 ± 0.82   |
| CSS total           | 40.79 ± 6.45  |
| Compulsion          | 5.31 ± 1.96   |
| Excessive anxiety   | 8.17 ± 2.32   |
| Extremism           | 9.97 ± 2.53   |
| Reassurance         | 8.95 ± 2.21   |
| Distrust to doctors | 8.37 ± 1.71   |
| DLS total           | 55.69 ± 9.05  |
| Attitude            | 17.28 ± 3.20  |
| Technical           | 20.97 ± 4.44  |
| Cognitive           | 6.79 ± 1.25   |
| Social              | 6.43 ± 1.58   |
| PACV total          | 44.89 ± 14.99 |
| Behaviour           | 1.33 ± 3.38   |
| Attitude            | 22.14 ± 10.79 |
| Safety and efficacy | 21.40 ± 4.74  |
| PACV                | <b>n (%)</b>  |
| Non hesitant        | 400 (68.7)    |
| Hesitant            | 182 (31.3)    |

Table 4 shows that the model applied with the factors discussed ( $\chi^2 = 163.303$ ,  $p = 0.001$ , Nagelkerke  $R^2 = 0.356$ ) is significant. It was found that the variables of marital status, education level, income, health care professional in the family, getting fully vaccinated, having sufficient knowledge about vaccines, Cyberchondria Severity score, and Digital Literacy score in the model were statistically significant, and the overall correct classification rate of the model was 77.0%. According to these results, it was seen that the established model was valid and utilizable.

In this model, parental hesitancy about childhood vaccinations was 3.26 times higher (95% CI, 1.56–6.81) in unmarried compared to married people, 2.77 times higher (95% CI, 1.33–5.74) in high school graduates compared to primary school graduates, 4.69 times (95% CI, 2.08–10.59), higher compared to those with no family health workers, 16.02 times higher (95% CI, 6.61–10.80) in those who did not have their complete vaccinations and 1.81 times higher (95% CI, 1.13–2.88) in those who did not have enough knowledge about the vaccines. Parental hesitancy to childhood vaccines increased as the Cyberchondria Severity score increased (95% CI, 1.02–1.09) and the Digital Literacy score decreased (95% CI, 0.34–0.87). There was no significant difference between parents' attitudes to vaccination based on their economic status ( $p > 0.05$ ).

## Discussion

Theorizing the development of hesitations about childhood vaccines is crucial for taking the necessary precautions. In recent years, parents have been hesitant about vaccination for different reasons (Attwell et al., 2021). It is essential to eliminate this hesitancy to achieve the goals of the expanded immunization program (Vladan et al., 2019). In refusing vaccination, the influence of religion and philosophy, individuals and groups, social media and communication instruments are as significant as state policies (Bozkurt, 2018). This study investigated the relationship between digital literacy, cyberchondria, and parents' hesitancy about childhood vaccines.

In the study, the mean CSS score was found  $40.79 \pm 6.45$ . Studies on cyberchondria were primarily based on cross-sectional data collected from university students and/or participants randomly selected from online platforms (Zheng et al., 2020; Zheng & Tandoc, 2020). In the literature, the mean score of university students from different departments was 36.9, while the mean score of first-year medical students was approximately 70 in the study of Aulia et al. (2020). In a survey conducted with parents, the cyberchondria score was considerably

low compared to our research (Avçin & Can, 2021). These different values in the cyberchondria severity scale score may be due to the differences in the sociodemographic characteristics of the population measured.

In the study, the mean score of the parents' total DLS score was  $55.69 \pm 9.05$ , which is moderate. Studies have found that parents' digital literacy scores vary (McDougall et al., 2018; Ozerbas & Ocal, 2019), and these changes may be due to their sociodemographic characteristics (European Audiovisual Observatory/Council of Europe, 2016; Vandoninck et al., 2010). The sociodemographic characteristics of our research group, such as an average level of education and a moderate economic status, can explain parents' intermediate digital literacy level in the present study.

In the study, 31.3% of the parents had hesitancy about childhood vaccines (Table 2). The studies examining vaccine hesitancy found the prevalence in a wide range of 15–52% (Dubé et al., 2016; Giambi et al., 2018; My et al., 2017). The prevalence rate of vaccine hesitancy is seen at much higher rates for COVID-19 (Xu et al., 2021; Temsah et al., 2021; Bianco et al., 2022). Parents who have children with several chronic conditions expressed deeper concerns about vaccine side effects for their children than for themselves (Akgün et al., 2022; Skeens et al., 2022). Since pro-vaccine, hesitant, and anti-vaccine parents have very different beliefs, health conditions and cultural backgrounds about vaccines, this is an expected outcome. Extended Immunization Program sources' success depends highly on parents' willingness to accept the vaccine. It is crucial to vaccinate children to achieve herd immunity and avoid vaccine hesitancy (Williamson & Glaab, 2018). New policies and educational programs regarding Extended Immunization Programs for risky groups are needed to reduce hesitancy and increase vaccination uptake.

Considering the study's results, it was found that parents' hesitancy about childhood vaccines was higher for single parents than for married ones. No study examining the relationship between vaccination hesitancy and marital status was found in the literature. However, vaccine hesitancy is a complex and multidimensional issue (Barrows et al., 2015). Considering that any sociodemographic factor that may affect the decision processes of the parents may also affect their decisions about their child, it is an important finding that the marital status included in the model fits in the model. Accordingly, single parents should be considered a risky group regarding vaccination hesitancy and supported in decision-making.

Among the parents participating in the study, high-school graduates were more hesitant about vaccination than primary-school graduates. Although there are numerous reasons for vaccine hesitancy, misinformation and debate about childhood vaccines concentrate on questioning the safety and efficacy of certain vaccines (Pluviano et al., 2017). While some studies suggest that being a healthcare professional and having a high education level are among the most important reasons for compliance with the vaccination program (Kalok et al., 2020; Nguyen et al., 2021; Reuben et al., 2020), some studies argue that these characteristics are the most important reasons for negative attitude (Alsubaie et al., 2019; Veldwijk et al., 2015). Several systematic reviews have highlighted the variability of correlations between vaccine hesitancy and education; however, there is no obvious pattern other than to show that education does not always imply confidence (Brown et al., 2010; Larson, Jarrett, Eckersberger, Smith, & Paterson, 2014). It is stated that the direct correlation between vaccination hesitancy and education level may be that parents' informative demands and inquiries tend to increase with the level of education. However, in our study, unlike primary school graduates, university graduates were found to have less hesitation about vaccination than high school graduates. This can be explained by the fact that parents with a lower level of education rely on authorities and have limited access to confusing information and can reach accurate information from health professionals better than high-school graduates and overcome their hesitations about vaccination, and university graduates may have higher hesitation

**Table 3**  
Parents' Attitudes towards childhood vaccines by sociodemographic characteristics, CSS and DLS scores (n = 582).

| Variables                                  | Vaccine hesitancy |              | $\chi^2$ | p            |
|--|-------------------|--------------|----------|--------------|
|  | Yes               | No           |          |              |
|  | n (%)             | n (%)        |          |              |
| Parent's age                               |                   |              |          |              |
| 18–29                                      | 42 (31.3)         | 92 (68.7)    | 0.001    | 0.984        |
| 30 and above                               | 140 (31.3)        | 308 (68.8)   |          |              |
| Parent's gender                            |                   |              |          |              |
| Female                                     | 176 (32.0)        | 374 (68.0)   | 2.470    | 0.116        |
| Male                                       | 6 (18.8)          | 26 (81.3)    |          |              |
| Marital status                             |                   |              |          |              |
| Married                                    | 155 (29.0)        | 379 (71.0)   | 15.187   | <b>0.001</b> |
| Not married                                | 27 (56.3)         | 21 (43.8)    |          |              |
| Education                                  |                   |              |          |              |
| Primary school                             | 18 (18.2)         | 81 (81.8)    | 31.311   | <b>0.001</b> |
| High school                                | 111 (43.2)        | 146 (56.8)   |          |              |
| University                                 | 53 (23.5)         | 173 (76.5)   |          |              |
| Financial status                           |                   |              |          |              |
| Less income than expenses                  | 39 (29.5)         | 93 (70.5)    | 8.452    | <b>0.009</b> |
| Equal income expenses                      | 135 (34.1)        | 261 (65.9)   |          |              |
| More income than expenses                  | 8 (14.8)          | 46 (85.2)    |          |              |
| Profession                                 |                   |              |          |              |
| Housewife                                  | 62 (30.1)         | 144 (69.9)   | 6.988    | 0.137        |
| Officer                                    | 85 (29.8)         | 200 (70.2)   |          |              |
| Worker                                     | 6 (15.4)          | 33 (84.6)    |          |              |
| Private sector employee                    | 1 (100.0)         | 0 (0.0)      |          |              |
| Non-worker                                 | 6 (40.0)          | 9 (60.0)     |          |              |
| Health insurance                           |                   |              |          |              |
| No   | 5 (16.7)          | 25 (83.3)    | 3.139    | 0.076        |
| Yes  | 177 (32.1)        | 375 (67.9)   |          |              |
| Health professionals in the family         |                   |              |          |              |
| Yes  | 10 (10.4)         | 86 (89.6)    | 23.264   | <b>0.001</b> |
| No   | 172 (35.4)        | 314 (64.6)   |          |              |
| Child age                                  |                   |              |          |              |
| 3  | 79 (31.9)         | 169 (68.1)   | 0.236    | 0.889        |
| 4  | 51 (29.8)         | 120 (70.2)   |          |              |
| 5  | 52 (31.9)         | 111 (68.1)   |          |              |
| Child gender                               |                   |              |          |              |
| Female                                     | 93 (33.0)         | 189 (67.0)   | 0.742    | 0.389        |
| Male                                       | 89 (29.7)         | 211 (70.3)   |          |              |
| Fully vaccinated (n = 562)                 |                   |              |          |              |
| Yes  | 139 (26.8)        | 379 (73.2)   | 44.300   | <b>0.001</b> |
| No   | 33 (75.0)         | 11 (25.0)    |          |              |
| Reasons for refusing vaccines              |                   |              |          |              |
| Social media                               | 15 (88.2)         | 2 (11.8)     | 3.477    | 0.176        |
| Distrust of vaccines                       | 11 (61.1)         | 7 (38.9)     |          |              |
| Side effects                               | 33 (75.0)         | 11 (25.0)    |          |              |
| Having sufficient knowledge about vaccines |                   |              |          |              |
| Yes  | 97 (27.6)         | 254 (72.4)   | 5.440    | <b>0.020</b> |
| No   | 85 (36.8)         | 146 (63.2)   |          |              |
|  | CCS               | DLS          |          |              |
| Vaccine hesitancy                          | Mean ± SD         | Mean ± SD    | t        | p            |
| Yes (n = 182)                              | 42.97 ± 6.06      | 54.86 ± 5.02 | -5.642   | <b>0.001</b> |
| No (n = 400)                               | 39.80 ± 6.38      | 57.53 ± 6.07 |          |              |

SD = Standard Deviation.

because they have more informative demands and searches via the internet.

The present study showed that the childhood vaccination hesitancy of the parents with a healthcare professional in their family was higher than those who did not have a healthcare professional in their family. Healthcare professionals were reported as the most reliable source of vaccine-related information by parents who were hesitant about vaccination, and the advice of healthcare professionals was found to be one of the most critical factors for improving the vaccination rate (Luthy et al., 2009; Wang et al., 2021). On the other hand, according to Giambi et al. (2018), only 84% of parents reported that they received a recommendation from their practitioner to vaccinate their children entirely. This finding confirms that vaccine hesitancy is also a concern of healthcare professionals. Studies have verified many times that society respects the recommendations of health professionals and is effective in

decision-making (Wang et al., 2021; Peretti-Watel et al., 2020). In this context, stakeholders should benefit from the guiding role of healthcare providers in dealing with vaccine hesitancy and rejection.

Parents' hesitancy about childhood vaccines was directly correlated with the cyberchondria severity score and inversely correlated with digital literacy (Table 4). A literature review reveals that most parents use the Internet for vaccine information (Giambi et al., 2018). However, online communication is uncontrolled and heavily powered by algorithms that contribute to and even amplify hearsay (Edwards & Hackell, 2016; Glanz et al., 2017). For this reason and similar other reasons, the abundance of misinformation about vaccines obscures science-backed knowledge and dramatically influences the communication skills of healthcare professionals and public immunization campaigns (Burki, 2019; Macdonald & Dubé, 2020). The results of the study in which digital literacy, which defines the intended use of online media in parents

**Table 4**  
Multivariate logistic regression analysis of vaccine hesitancy (n = 582).

| Variables   | B          | S.E   | p     | Odds Ratio | %95 Confidence interval |                |
|---|------------|-------|-------|------------|-------------------------|----------------|
|   |            |       |       |            | Lower boundary          | Lower boundary |
| <b>Marital status</b>                             |            |       |       |            |                         |                |
| Married   | <b>ref</b> |       |       | <b>1.0</b> |                         |                |
| Not married                                       | 1.183      | 0.375 | 0.002 | 3.26       | 1.56                    | 6.81           |
| <b>Education</b>                                  |            |       |       |            |                         |                |
| Primary school                                    | <b>ref</b> |       |       | <b>1.0</b> |                         |                |
| High school                                       | 1.019      | 0.372 | 0.006 | 2.77       | 1.33                    | 5.74           |
| University  | -0.553     | 0.462 | 0.232 | 0.575      | 0.23                    | 1.42           |
| <b>Financial status</b>                           |            |       |       |            |                         |                |
| Less income than expenses                         | <b>ref</b> |       |       | <b>1.0</b> |                         |                |
| Equal income-expenses                             | 0.465      | 0.540 | 0.390 | 1.59       | 0.55                    | 4.58           |
| More income than expenses                         | 0.548      | 0.479 | 0.252 | 1.73       | 0.67                    | 4.42           |
| <b>Existing health professional in the family</b> |            |       |       |            |                         |                |
| Yes   | <b>ref</b> |       |       | <b>1.0</b> |                         |                |
| No  | 1.547      | 0.415 | 0.001 | 4.69       | 2.08                    | 10.59          |
| <b>Fully vaccinated</b>                           |            |       |       |            |                         |                |
| Yes   | <b>ref</b> |       |       | <b>1.0</b> |                         |                |
| No  | 2.774      | 0.451 | 0.001 | 16.02      | 6.61                    | 10.80          |
| <b>Having sufficient knowledge about vaccines</b> |            |       |       |            |                         |                |
| Yes   | <b>ref</b> |       |       | <b>1.0</b> |                         |                |
| No  | 0.594      | 0.238 | 0.013 | 1.81       | 1.13                    | 2.88           |
| CSS   | 0.057      | 0.019 | 0.001 | 1.05       | 1.02                    | 1.09           |
| DLS   | -0.058     | 0.016 | 0.001 | 0.46       | 0.34                    | 0.87           |

ref: Reference variable, Nagelkerke  $R^2 = 0.356$ ,  $\chi^2 = 163.303$ ,  $p = 0.001$ .

who are hesitant about vaccination, is lower, and the severity of cyberchondria resulting from excessive or repeated online health information searches is higher, is similar to the existing evidence. Determining the seriousness of cyberchondria in parents, developing preventive strategies, and increasing digital literacy can prevent vaccination hesitancy in parents.

#### Practice implications

Vaccination is one of the issues that nurses should consider within the scope of maintaining welfare for all. It is of great importance that childhood vaccination refusals can interfere with children's health rights and the possibility of severe diseases. For children, parents are the decision maker about their child's vaccination. At this point, it is emphasized that the essential duty of pediatric nurses is family education. Pediatric nurses should answer parents' questions about vaccines in a clear, transparent and understandable way with strong scientific evidence. It will be essential to include evidence-based information on the vaccine portal of official sites and to use this portal to inform parents. The fact that parents have accurate and reliable information about vaccines may affect their attitudes and behaviours positively. Therefore, the level of cyberchondria among parents should be reduced, and their digital literacy should be increased.

#### Strengths of the study

The results of this study provide new and powerful information to the literature on vaccine hesitancy and related factors. The study is one of the first to evaluate the attitudes of cyberchondria and digital literacy towards vaccines in parents with children 3–5 years old. In addition, the fact that other biases were controlled in the study apart from the sampling method and the research group reflecting Turkish society is one of the strengths of the research.

#### Limitations

Our study had some limitations. First, cross-sectional studies have methodological limitations, and the results can only be generalized to

populations with similar characteristics. Also, the sample is a convenience sample that may not represent all parents. Second, since the complete immunization status of the children was based on the self-reported data provided by the parents, there may be a recall bias which can result in an over- or under-estimation. Third, using an online survey may limit the representativeness of the results. Although the survey link was shared four times at different times to increase participation in the research and reduce the response bias, the connection was never clicked by the potential participants, and the people may not have responded. Although eight people did not want to participate, they may not have declared it. However, the questionnaire did not include identifiable data, and participants were assured that all identities would be kept anonymous. As such, the findings are likely to be authentic.

#### Conclusion

According to the study's findings, one-third of the parents had hesitations about childhood vaccines. Cyberchondria and Digital Literacy levels of the participants were moderate. Training programs are required to reduce the level of cyberchondria among parents, enhance parents' digital literacy, and raise awareness of cyberchondria among healthcare professionals. While digital literacy reduces vaccine hesitancy, cyberchondria increases it. The study results showed that digital literacy, which defines the intended use of online media in parents who are hesitant about vaccination, is lower, and the severity of cyberchondria resulting from excessive or repeated online health information searches is higher. These findings are similar to the existing evidence. As can be seen in the study, although vaccination hesitancy was a severe problem, it was seen that the hesitations of digitally illiterate people were increasing. Training programs should be organized to improve digital literacy and access to health information. As cyberchondria increases, it is essential to raise awareness about cyberchondria of the parents, to direct parents to the sources based on the data of international authorities, and to increase the level of trust in first-hand sources such as healthcare professionals. It is recommended to raise parents' awareness about vaccines, improve their digital literacy, and inform them about the methods of accessing correct information. It is recommended to evaluate the relationship between the source of information and vaccine hesitancy in future studies.

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#### CRediT authorship contribution statement

**Fadime Ustuner Top:** Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Project administration.  
**Celalettin Çevik:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing.  
**Nebahat Bora Güneş:** Conceptualization, Writing – original draft, Writing – review & editing, Visualization.

#### Declaration of Competing Interest

The authors declare that there is no conflict of interest.

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